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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/712,945	11/13/2003	Jae Suk Lee	20059/PIA30962	9550

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EXAMINER

ARENA, ANDREW OWENS

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 01/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/712,945	Applicant(s) LEE, JAE SUK	
	Examiner Andrew O. Arena	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 12-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 12-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11/13/2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date: _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 12 and 14 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.
3. Claim 12 recites "the second metal lines prevent ions of the first metal lines from being diffused into the substrate." Relevant parts of the specification ([0018], [0021], [0022]) describe that the second metal lines prevent ions of the second metal lines from being diffused into the substrate via a barrier layer (116), but make no mention of the diffusion of ions of the first metal lines. It furthermore defies intuition that the second metal lines have the capability to prevent ions of the first metal lines from being diffused into the substrate, since the first metal lines contact the substrate directly without intervention of the second metal lines. The specification neither discloses nor obviates the cited recitation. The claim is thus rendered unclear; for rejection purposes, said recitation will be interpreted as "the second metal lines prevent ions of the second metal lines from being diffused into the substrate."

4. Claim 14 recites "the first conductive layer is formed of an Al alloy containing greater than 5% Cu." Relevant parts of the specification [0011] In 7-8) disclose "an Al alloy containing 5% or less Cu is used as the first conductive layer." The specification neither discloses nor obviates the cited recitation.

5. Claim 21 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

6. Claim 21 recites "the first insulator [is] deposited by a plating process." However, a plating process is used to deposit metal, it is unclear how a plating process deposits the first insulator.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 12, 13, 15, 16, and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Anand (US 6,500,748), hereinafter Anand.

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8. Regarding claim 12, Anand discloses, in Fig. 7, a metal line structure (col 1 ln 10) formed in a semiconductor device (col 1 ln 9), comprising:

first metal lines (17a&b; col 6 ln 28-29) formed on a substrate (11; col 6 ln 8), the first metal lines having a first barrier metal layer (17a; col 6 ln 23) and a first conductive layer (17b; col 6 ln 25-26);

a first interlayer insulator (15, 24, 25; col 6 ln 12-13, 18) between adjacent ones of the first metal lines;

second metal lines (20a&b; col 6 ln 50-52) formed on respective ones of the first metal lines, the second metal lines having a second barrier metal layer (20a; col 6 ln 46) and a second conductive layer (20b; col 6 ln 48-49); and

a second interlayer insulator (18, 26, 27; col 6 ln 36-37, 40) between adjacent ones of the second metal lines;

wherein the first conductive layer is formed of a material (aluminum copper alloy; col 7 ln 66-67) different from a material of the second conductive layer (copper; col 8 ln 66-67), and the second metal lines prevent ions of the second metal lines from being diffused into the substrate (col 8 ln 60).

9. Further regarding claim 12, if applicant did intend to claim "the second metal lines prevent ions of the first metal lines from being diffused into the substrate," Anand still inherently anticipates this limitation. Since Anand discloses the claimed structure, his device likewise exhibits this claimed property.

10. Regarding claim 13, Anand discloses (Fig 7) each of the first metal lines (17a&b) has a thickness substantially identical to a thickness of the second metal lines. (20a&b).

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11. Regarding claim 15, Anand discloses (Fig 7) the first interlayer insulator (15+24+25) has a thickness substantially identical to a thickness of the second interlayer insulator (18+26+27).

12. Regarding claim 16, Anand discloses the second conductive layer is substantially formed of Cu (col 8 ln 66-67).

13. Regarding claim 20, Anand discloses the first and the second barrier metal layers comprise at least one of Ti, TiN (col 7 ln 60-62; col 8 ln 60-62).

14. Regarding claim 21, the product-by-process limitation "the first conductive layer and the first interlayer insulator are deposited by a plating process" has not been given patentable weight. The case law establishing this precedent follows:

"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Anand in view of Xu et al. (US 5,847,461) – hereinafter Xu.

17. Regarding claim 14, Anand discloses the first conductive layer is formed of an Al alloy containing Cu (col 7 ln 66-67). Anand differs from the claimed invention only in not expressly disclosing "greater than 5% Cu." Xu teaches the Al/Cu alloy contains 0-10% Cu (col 4 ln 38-41). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made that the Al alloy of Anand contain greater than 5% Cu; at least to achieve desired electrical properties.

18. Claims 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand in view of reference U (on 892; see pg 2, 9:30AM N5.4, "Thermal stability study of the interconnect system with fluorinated silicate glass as IMD layers", esp ln 1-4), hereinafter U.

19. Regarding claims 17-19, Anand discloses the first interlayer insulator is made of a silicate glass (col 7 ln 19-20), but differs from the claimed invention only in not expressly disclosing "fluorinated silicate glass (FSG)." Reference U teaches the use of FSG in an analogous structure. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to use FSG, as taught by U, as the silicate glass of Anand; at least to enhance device reliability due to thermal stability of FSG (U line 3-4).

20. Further regarding claims 17-19, the product-by-process limitations:

"deposited by a high density plasma (HDP) process" of claim 17;

"deposited by a plasma enhanced chemical vapor deposition (PECVD) process"

of claim 18;

"deposited by a plasma enhanced chemical vapor deposition (PECVD) process"
of claim 19; and

have not been given patentable weight, in accordance with the precedent:

"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Response to Arguments

21. Applicant's amendments to the title, Claims 13, 15-19, and newly added claim 21, are accepted as not introducing new matter. Accordingly, the previously presented objections to Claims 17-19 are withdrawn, and the previously presented rejections under 35 USC § 112, second paragraph of Claims 13-15 and 19 are withdrawn.

22. The amendment to claims 12 and 14 add new matter (¶¶3-4 of this office action).

23. Applicant's arguments filed 11/02/2005 with respect to claim 12 have been fully considered but they are not persuasive.

24. Examiner does not concur that "Anand does not disclose or suggest that the material of the first metal line is different than the material of the second metal line and/or that the second metal lines prevent ions of the first metal lines from being diffused into the substrate." Anand discloses the first conductive layer is formed of a material (aluminum copper alloy; col 7 ln 66-67) different from a material of the second conductive layer (copper; col 8 ln 66-67). Anand anticipates the claimed structure, therefore the device of Anand exhibits the claimed property "the second metal lines

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prevent ions of the first metal lines from being diffused into the substrate.” Applicant's argument that “Anand provides no reason to use different metals in the two metal lines” is irrelevant since Anand anticipates the claimed structure.

25. Applicant's arguments with respect to lwaski have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

26. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew O. Arena whose telephone number is (571) 272-5976. The examiner can normally be reached on M-F 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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